

CONVOCA'TION ADDRESS

University of Toronto,

OCTOBER 2nd, 1899.

BY THE PRESIDENT,

JAMES LOUDON, LL.D.

TORONTO :

ROWSSELL & HUTCHISON, PRINTERS.

1899.

RB167 368

Convocation Address.

DURING the past year no other question affecting our system of public instruction has received more attention than that of technical education. The impression has become general that the interests of the country demand increased facilities in this direction. As yet, however, no consensus of opinion has been arrived at on the two essential points of the movement. What does the country need? How is it to be obtained? In view of the University's interest in the subject especially as regards the higher forms of technical training, it has appeared to me appropriate that I should contribute my quota of information and criticism. We are still at the stage of abstract discussion and of propositions more or less vague. A full discussion now from all points of view is the surest means of avoiding mistakes in the final settlement.

Much of the difficulty surrounding the question arises from its newness. Some twenty-five years ago technical education was a burning question in Toronto, and at that time a solution was found to which I shall refer presently. But the recollection of the discussion of that time has passed from the minds of the present educational generation, and we are face to face with the old problem in a new form.

Before proceeding further, let us consider what we mean by technical education. This is necessary, since the term has been used so loosely in the recent discussions as to lead to great confusion. Strictly speaking, the term technical education is applicable to any course of training for a trade or profession, not excluding the so-called learned professions. I will use the term, however, in the more restricted sense common in England, viz., "instruction in those principles of science and art which are applicable to industrial pursuits." In technical training these prin-

ciples are elucidated, and their bearing emphasized. As examples of technical education with us may be mentioned the work of the School of Practical Science, of the Toronto Technical School, and of the Art Schools. I gather that, in the recent discussions, it is the instruction of the artisan and the commercial employee which most people have had in mind. In this kind of instruction the merest beginnings have been made in Ontario, while in the higher technical education much has been done. It is in this lower grade that the contrast is most glaring as between this country and England, and especially as between this country and Germany. From England and Germany we have much to learn, and it is to these countries, as also to France and the United States, that we must look if we desire to profit by their experience in solving the problems which now confront us. In none of these countries must we expect to find a ready made system adapted to our special conditions, but undoubtedly the most instructive and suggestive system for us, as it has been for others, is that of Germany.

The German system is no new development. It is just thirty years since an eminent engineer, J. Scott Russell, startled the English people by describing that system, and by pointing out the necessity, for England, of adopting similar methods if she wished to maintain her position as the leading industrial country of the world. Since that time books on the subject have been published, civic committees, commissions and congresses have considered the question in all its phases. As an outcome of the movement in England, wealthy corporations and guilds have established such great schools as the City and Guilds Institute, and the Finsbury Technical College, in London. Successful efforts have also been made in other places to found technical schools, although, as compared with what Germany has done, such efforts have been somewhat spasmodic, and England cannot yet be said to have realized the magnitude or the strong points of the system elaborated by her continental rival.

The warning of Mr. Russell was well timed. In twenty-five years Germany has increased her manufacturing capacity ten-

fold, so that it equals that of England ; her shipping has increased twenty-fold, so that as regards steamships at least, Germany is now the second in the world. German sugar rules the world's markets ; German chemists have revolutionized the dyeing industries ; Germany supplies most of the electrical plants in Europe, in Central America, and in the East ; in iron and steel industries she is pressing close upon the heels of England. Germany, in fine, has attained the position of a first class commercial and industrial power, and aspires to universal supremacy. Side by side with this marvellous progress has gone on the development of her system of technical education, in the wider as well as the narrower sense.

Now, what place does technical training hold in the German educational system ? When we consider that system as a whole, we are at once struck with the fact that a very sharp line of demarcation is drawn between general and technical education. In no country is general education wider or more general, and in no country is technical education more severely special. The elementary school with its three grades or classes, the secondary schools (Gymnasium, Realschule, etc.), and the universities cover the whole ground of general education. Various classes of schools, to which I shall now refer somewhat in detail, cover the whole field of technical education.

The lowest grade of school which gives technical training is the so-called Fortbildungsschule, *i.e.*, a school for supplementing the work of the elementary schools. This school is the point at which the general and technical systems overlap. These schools vary according to locality and prevailing industries. A boy leaves the elementary school (what we should call the public school), and becomes an apprentice. While an apprentice, he must attend the Fortbildungsschule at least up to his eighteenth year. But he does not attend to learn a trade. These schools do not teach trades either wholly or in part. Their object is (1) to supplement and continue the general instruction of the elementary school, and (2) to give elementary technical instruction, such as drawing or the like, bearing on the various trades represented

by the pupils in attendance. A typical curriculum is that of the school at Nürnberg, the technical division of which includes in its lower course : German language, composition, elementary economics, physics and chemistry (technical), elementary physiology and hygiene, arithmetic and mensuration, together with drawing (freehand and linear), to which special importance is attached. In its more advanced course, book-keeping, commercial correspondence, higher commercial and technical arithmetic and technical drawing, are prominent subjects. The school has also a more elementary course of general learning with the merest beginnings of technical instruction in business correspondence, etc. To illustrate the variation in the technical part of the course, it may be noted that in this school, wood-workers, metal-workers, lithographers and painters, have special and extensive courses of drawing; waiters and barbers take French instead of drawing; bakers and butchers are very properly relieved of drawing. The general subjects are the same for all. Instruction is given evenings, mornings, and Sundays, to suit the hours of the apprentices and labourers, for whom the Fortbildungsschule practically exists. In Hamburg, for example, last year, out of 3,042 pupils, 2,424 were apprentices or helpers; 486 were schoolboys taking special subjects such as drawing. No less than 40 trades are represented in the Hamburg schools, and the technical part of the curriculum is correspondingly elastic. I have described this part of the system somewhat fully because it seems to have most bearing on the movement here.

Next above the Fortbildungsschule, we come to a numerous class of schools. The whole class is denoted by the terms Höhere Industrieschulen, and Technische Fachschulen, *i.e.*, technical schools of a grade higher than the elementary. I might explain parenthetically that, though these are called "higher" schools, curiously enough the next grade above them is known as the "technical high school." Coming back now to these so-called "higher" schools, we note as the divisions of them, first, the Baugewerkschulen and Technica. As an example of the former may be cited the Baugewerkschule, or school for the building trades,

at Hamburg, attended by bricklayers, stone masons and carpenters only—the total number last year being 45 in summer and 256 in winter. This school is under the direction of an architect, and the curriculum forms part of the course for architects. As an example of a Technicum, may be mentioned that at Mittweida (in Saxony) for the training of men as mechanical and electrical engineers, and also as foremen in electrical workshops, etc.

Secondly, we have in this class *Gewerbeschulen* (schools for artisans). As an example of them may be mentioned the *Kunstgewerbeschule* (a school for the more artistic trades), at Hamburg, attended by carvers, sculptors, engravers, painters, cabinetmakers and decorators.

Third, we have technical schools for single trades, *e.g.*, the school for tanners at Freiberg, schools for watchmakers, gardeners, etc.

Fourth, there are still in this class of “higher” schools, the commercial schools. It is worth noting that French and English form part of the curriculum in these schools, and that the pupils consist almost altogether of those actually engaged in business. Thus, at Hamburg, of the 174 pupils in attendance last year only four were not engaged in business.

We come now to the schools of highest grade, among which are the *Technische Hochschulen* (or technical high schools), known also as *Polytechnica*, which take rank with the universities, and train men as engineers, architects, chemists, physicists, etc. Of these academies, which correspond in general to the School of Practical Science with us, Germany possesses nine. In this highest grade we have also such institutions as the famous *Berg-Academie*, or mining academy, in Freiberg, and the *Forst-Academien*, or schools of forestry, at Neustadt-Eberswald, Aschaffenberg, etc. The latter are mentioned on account of the interest which the subject of forestry should have for us. In addition to all these, there are the universities, 21 in number, which are intimately connected through their scientific departments with the highest interests of trade.

An idea of the general diffusion of technical education may be gained from the statistics regarding Saxony, with its 4,000,000 inhabitants. It possesses

112 Fortbildungsschulen with	10,000	pupils.
39 Höhere Industrieschulen with ..	10,000	"
44 Commercial " " ..	4,800	"
11 Agricultural " " ..	700	"
25 Technical Schools for women and girls with	4,000	"

The city of Hamburg alone, with a population of about 700,000, has 17 technical schools with almost 5,000 pupils.

Having thus outlined the technical educational system of Germany, let us now inquire as to its special features. The system covers the whole field of industry and commerce. It distinguishes clearly between the general and the technical. No attempt is made to put a veneer of technical training on a defective general training. It distinguishes between the training of the director, the foreman and the operative. In all grades it concentrates effort on the underlying principles of art and science and their application. The general result is a thoroughly trained body of workmen under scientific leadership.

We have seen that Germany is rapidly overtaking Great Britain in the industrial race. What is the secret of this remarkable achievement? It does not seem to be due wholly to the training of the rank and file of the workmen, for it is well known that, notwithstanding educational disadvantages, the British workman has, in many respects, no superior in the workshop. We must seek the cause primarily in the extent to which the highest teachings of science have been turned to account. Here, as elsewhere, success has depended upon leadership combined, of course, with effective practical training all along the line. As an illustration of German methods, take the fact that German chemical experts, trained in the universities and polytechnica, have revolutionized the sugar industry, the dyeing industry, and the manufacture of chemicals. In one factory alone, the Badische

Anilin u.-Soda Fabrik at Ludwigshafen, over 100 chemical experts are engaged in special researches with a view to discovering new processes or new products. So also in electrical works we find that experts in physics are employed in research work. Of chemical experts the number just mentioned is greater than that of those employed in the same line of work in the whole of England, a fact which goes to show that it is evidently the British manufacturer who above all needs enlightenment. The British manufacturer, though a very estimable citizen, reminds one, in his attitude towards scientific knowledge, of the Parisians of a hundred years ago, who beheaded Lavoisier amid cries of "nous n'avons plus besoin de savants." It is impossible to insist too strongly on this feature of the German industrial system. I fear that the belief in this country is too common that the short road to industrial prosperity lies through the adoption of an extensive system of elementary technical training. Without anticipating what I shall say further on as to our special needs, I should like to state emphatically here my conviction that no diffusion of technical training will in itself be effective if we do not take care to maintain the higher and the highest kind of scientific instruction, and if our manufacturers do not utilize this expert knowledge.

Unfortunately, it is not only the British manufacturer who needs the co-operation of the *savant*, but also the British merchant. According to recent British consular reports, both merchants and manufacturers have yet to take another leaf out of the German book in the matter of conducting foreign business. Their deficiencies have been referred to by almost every British consul on the Continent. Take, for example, the last report of Consul Powell on the trade of Stettin and district. In it he says: "Much of the commercial knowledge of Germany has been supplied by young Germans who have been employed as clerks in Great Britain, mostly as foreign correspondents, who make no secret that their object is to obtain sufficient knowledge of business and facility with the English language to enable them to fill better positions in their own country." He says that British clerks cannot be used as foreign correspondents, because not one

in a thousand can correspond correctly in any foreign language, and therefore British merchants are forced to use, as confidential corresponding clerks, young foreigners who gain an intimate knowledge of their employers' business, and then leave them to transfer that knowledge to a foreign land. The cure for this is obvious: "British youths of the commercial classes must learn foreign languages." To this may be added the following advice from a well-known American electrical engineer: "If an impartial observer were to study the export trade of the world as it is now developing, and then frame only two maxims, I think he would say: first, manufacture well and cheaply; second, learn foreign languages."

Just here I would direct attention parenthetically to another fact which, while it has an important bearing on the question of international competition in trade, has unfortunately at the same time a harmful influence on the interests of the trained workman. This fact has been brought very pointedly to our notice by the appearance in the markets of the world of our American cousin, whose dramatic success in such matters as the Atbara bridge contract and the sales of American locomotives in England is not to be explained by ordinary platform theories concerning technical education. To understand the character of this new competition, one has but to recall the long list of American inventions like the sewing-machine, the reaping machine, the planer, and machine-tools without end. The object of the American inventor is not only to reduce the number of workmen by labour-saving machines, but to invent machines which can be operated by low-wage attendants. If you will understand fully what this means you may see any day in one of our bicycle factories a set of machines operated by a single unskilled labourer, and doing the work of 150 men. The stronghold of American manufacture is machine-tools, and as an outcome of these the "standardization" of products, which renders it possible to replace parts or to duplicate structures on short notice. American success in the manufacture of mechanical products is due, then, not to the technical training of the workman, but to the labours of the inventor, and to his

genius for mechanics. The American workshop, like the German laboratory, is pervaded by the spirit of invention and discovery. The American inventor is duplicating the achievements of the German chemist, and affords another proof that the winning of industrial victories does not happen now-a-days without the direction of leaders who devote themselves exclusively to the work of discovery or invention.

The present movement here in favour of technical education is, I take it, largely an echo of the discussions in England and elsewhere, to which I have already referred. The growing importance of our manufactures and trade has also contributed to arouse public interest. In any consideration of this matter care should be exercised to duly appreciate the special conditions which prevail here, and not to raise false hopes as to the results which are to flow from the adoption of any system of technical training. I recall the enthusiasm for popular evening scientific lectures which characterized the agitation of some twenty-five years ago, and the belief held by many that through them industrial prosperity would be assured. It was a proposition to build the edifice from the roof downward. Happily for the cause of technical education, the Government of that time abandoned such a plan, and established, on a report prepared by myself, the School of Practical Science.

That institution, as I have said, corresponds in the main to the German Polytechnicum, and forms the proper basis, as does its German prototype, of a technical system. It supplies the leaders in technical knowledge, the teachers in applied science. That the establishment of this school was timely is shown by its phenomenal success, as may be seen from the published lists of its graduates. In addition to their general employment as engineers, architects, surveyors and chemists, we find them engaged in such a variety of occupations as the following: railways, canals and river improvements, mines and reduction works, iron mills, foundries and machine shops, marine engineering works, structural steel works, bridge works, electrical works, hydraulic power works, telephone companies' works, chemical manufactures and sugar factories.

These graduates are thus engaged in directing industries not only in Canada and the United States, but also in Mexico, Central America, South Africa, and are to be found even as far away as Java—a fact which shows clearly that the school has since its inception made for itself an enviable record.

So far we have proceeded upon right lines. We have provided for the training of the directing minds to an extent fairly commensurate with the requirements of the country. What provision shall be made for those who act under others, for the rank and file of the industrial army? This seems to me to be the real question in the present movement. The problem is to find some means of making the efforts of the workmen and workwomen of our country more intelligent and more effective, some means of supplementing the training of the workshop or the counting house.

To be of any value such instruction must, I think, bear directly upon the trade or business which the pupil is learning. Besides, the training of the pupil in general knowledge must be assured in so far at least as regards his capacity to avail himself of the special instruction imparted. These are the two fundamental points of the German system. In Germany, as I have shown, technical training is for those who are learning, or have learned, a trade or business. It begins where the public school course leaves off, and so important is the general training of the pupil considered that it is continued up to his eighteenth year. The seed of technical training is not prematurely scattered broadcast in Germany in the hope that some of it may ultimately take root and grow. Even in the most elementary grades, the pupil has begun his lifework, and his training is varied with direct reference to it. The system does not divert the mind of the child and fritter away his time during his course of general learning by untimely efforts to instil what can only be profitably learned during his trade or business apprenticeship. In this the German system is eminently practical.

The simplest way of defining generally what sort of instruction should be given in an elementary technical school here is to say

that the apprentice, the artisan, or the youth entering on commercial life, should have the means of acquiring some of the special knowledge possessed by his professional chief. For example, the carpenter and bricklayer or their apprentices should be taught some of the elements of architectural science, as a means of enabling them to carry out more intelligently and economically the directions of the architect, and similarly for other trades, or for commercial pursuits.

In a highly organized system there should be not only different grades of such schools, but also different kinds in the same grade. The industrial needs of this country do not seem to demand, or indeed to render possible, any such elaborate system at present. If, as seems reasonable, there is to be but one grade of technical schools in addition to those now existing, it is evident that care must be taken not only in the selection of the pupil who is to receive this training, but also in the selection of the teacher who is to impart it.

The teachers must be specially qualified. They must have the necessary scientific and technical knowledge, and they must be familiar with the requirements of the trades concerned. To obtain teachers of such varied attainments is perhaps more difficult than to find specialists who could give instruction in individual trades. Where, as in Germany, numbers are large, and teachers and schools can be multiplied, the classification of trades is possible, and courses can be framed to meet the special needs of all. The city of Hamburg furnishes a good example of such a cycle of schools.

That the technical school requires a very special sort of staff is beginning to be understood in England at least, where the failure of some of these schools is attributed to the deficiencies of the teachers. Indeed, Sir W. H. Preece, Director of the English Post Office Telegraph service, in his address as President of the Institute of Civil Engineers (1898), uses the following severe language regarding the teaching in technical schools: "Our educational methods have begun at the wrong end. . . . We are suffering from a lack of competent teachers. A teacher who has had no training

in the practical world is worse than useless, for he imparts ideas derived from his inner consciousness, or from the false teaching of his own abstract profession, which lead to mischief," etc.

It has been suggested that perhaps all the technical instruction required here could be given in the High Schools. It is hardly necessary, I hope, to explain that this is not a practicable plan. A High School cannot be transformed into a Technical School by simply changing its name any more than the Arts department of a University can be transformed into a School of Engineering by simply calling it such. The High School is, or should be, concerned in general, not technical, training. It has already been complicated and diverted from its object by the introduction of technical and semi-technical subjects, and to proceed further along the same line would be to further impair its usefulness. In Germany there is no such confusion as to the object of the different classes of schools. If there are too many High Schools here, by all means let some of them be dispensed with; and if in any locality a Technical School is needed, let it be established, but let care be taken to have it organized and equipped for its special work. The adding of further technical training to the curriculum of the High Schools would be abortive in its results, and harmful to these schools.

It is held by some that technical education should be imparted in the Public Schools. This is the recommendation of the committee appointed by the conference of the Boards of Trade held last summer. That report recommends "that technical education in order to be thoroughly successful, should be part of the foundation of our general educational system, and elementary technology should be as speedily introduced into all forms of the Public Schools in the Province as time and circumstances will permit," etc. This report is still under consideration, and I hope that this cause at least will not be passed. The Public School course is all too short to ensure a thorough elementary general training. This is felt to be the case in Germany, as I have shown. The Public School curriculum is already overloaded, and why increase the burden and the complexity of organization? Besides, the

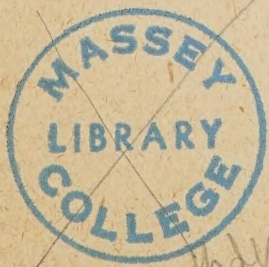
difficulty of securing teachers for a general scheme of this kind is practically insuperable. This is no reflection on the ability of the Public School teachers, but, as we have already seen, very special teachers are required for this work, and they can never be found or prepared in sufficient numbers to meet this new and peculiar demand. And lastly, the trade of the elementary pupil has not been chosen in perhaps one case out of ten. How shall we select the particular form of technical instruction which he shall have?

The only subject bearing (but indirectly, it is true) on technical education which might have a place in the elementary school is, in my opinion, manual training. If we define manual training as exercises serving to train the pupil in an elementary and general way to use his hands, I consider it a discipline profitable for general education, and one which might be taken by every child whether he should afterward become an artisan or not.

In considering our present needs, I have not referred to schools confined to the complete teaching of certain trades, such for example as the Baron de Hirsch Trade School of New York, founded eight years ago, which has full courses in house-painting, sign-painting, plumbing, carpentry, and machinists' work. No one would, I imagine, advocate the establishment of such schools here, although in view of the obstacles in learning a complete trade caused by the decline of the apprenticeship system and the increasing use of machine-tools, it may be necessary some day to institute them.

In conclusion, I would point out that the work I have been considering is, however important, only auxiliary in the development of our vast material resources. Progress in this direction will not be assured by technical education alone. Nor will it be assured by capital and enterprise alone, as has been proved by the result of the international competition between England and Germany. True, capital is essential, and no less essential is the spirit of enterprise and hopefulness which leads its possessors to invest it. The true line of progress lies in the direction of the co-operation of capital and enterprise with high technical know-

ledge. Capital and enterprise are in turn affected by the action of our legislators, on whom so much depends in the encouragement of trade by wise enactments and by its direction into proper channels. It is to our legislators that the capitalist must look for those enactments which will encourage him to engage in what is profitable to him and to the community at large. Under the united forces of capital, enterprise and technical knowledge, aided by industry and frugality on the part of the people, our country will be enabled to make the best use of its great opportunities, and to win for itself great gain without loss, nay, with added gain, to the world at large.



Withdrawn
Apr 1992

